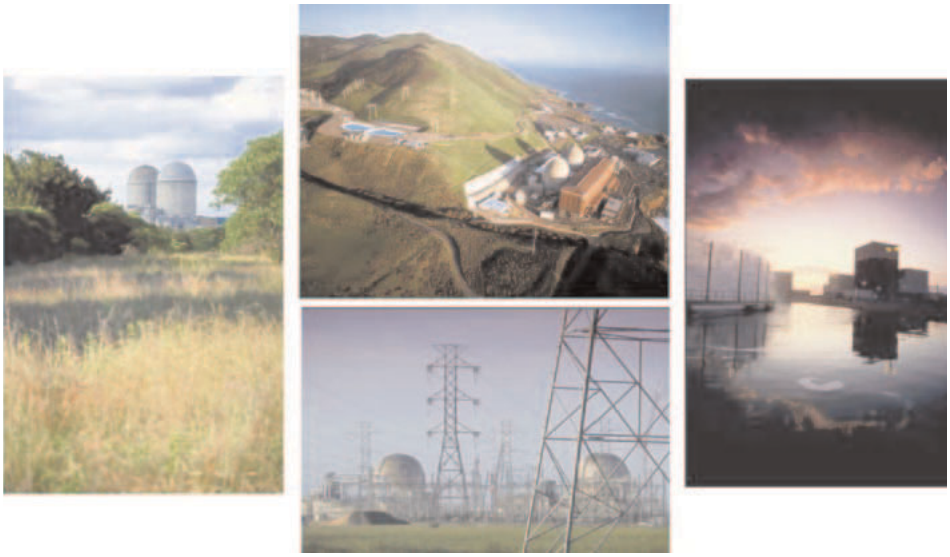
Bechtel's Nuclear Plant Completion, Recovery, *and* Restart Experience



Bechtel has unparalleled experience in the successful completion of nuclear power plants from various stages of completion, and on recoveries and restarts of nuclear plants that have experienced interrupted operation or performance problems. In addition to designing and/or constructing more U.S. nuclear power plants than any other company, Bechtel has earned a well deserved reputation for responding to owner requests to assume responsibility for nuclear power plant projects already underway and completing them. As utilities were forced to halt their projects for safety, quality, or cost reasons, they frequently turned to Bechtel to finish their plants.

On each of the plant recoveries, Bechtel used proven and effective design, engineering, and construction tools and processes. We appropriately staffed each recovery with qualified and experienced personnel, and we approached each recovery with a positive "can-do, make it happen" attitude. We maintained the necessary flexibility, innovation, and adaptability to changing conditions to overcome challenges without impacting established completion schedules. Our unique experience in successfully completing unfinished nuclear power plants and restarting operational nuclear power plants, our effective project management, and our wealth of committed, talented, and experienced professionals make Bechtel the best choice for helping utilities in troubled times or to improve their operational performance.

- Bechtel's unparalleled nuclear recovery, restart, and completion experience:
  - Comanche Peak 1 & 2
  - Diablo Canyon
  - STP 1 & 2
  - Perry
  - Limerick 2
  - Browns Ferry 1, 2, & 3
  - D. C. Cook 1 & 2
- Bechtel brought several halted nuclear power plant projects to successful commercial operation after others had failed.
- Bechtel uses state-of-the-art design, engineering, and construction tools and processes.
- Bechtel maintains the necessary flexibility, innovation, and adaptability to changing conditions to overcome challenges without impacting established completion schedules.
- Bechtel's unique experience in successfully completing unfinished nuclear power plants and restarting operational nuclear plants, combined with our effective project management and wealth of committed and talented professionals make us the best choice for helping utilities in troubled times or to improve their operational performance.

Comanche Peak Nuclear Station, Units 1 & 2

PLANT COMPLETION

Comanche Peak is an example of Bechtel's project management succeeding where other contractors failed. Construction of Comanche Peak was years behind schedule, almost $9 billion over the original estimate, and stopped by court order when Bechtel was asked to assume management responsibility for completion of the facility.

Key Bechtel managers worked with the customer to complete construction of Unit 1. In addition to normal project management activities, we assisted the customer in obtaining all necessary licenses and establishing credibility with stakeholders in the operation of a nuclear facility. In only 2 years, Unit 1 reached commercial operation.

Because of our management performance and the credibility we established with the stakeholders on Unit 1, the customer asked Bechtel to complete design, construction, and startup of Unit 2. Our management of this effort resulted in 2.5 million safe jobhours, and NRC characterization of Unit 2 management as "excellent."

Diablo Canyon Power Plant, Units 1 & 2

PLANT COMPLETION

The day fuel loading began on Diablo Canyon Unit 1, PG&E engineers discovered that some incorrect figures had been used in the analyses of the plant's ability to withstand earthquakes. The NRC was notified, fuel loading was suspended, and the NRC ordered a review of the plant's design by an independent engineering firm.

Bechtel was retained to act as project manager for Diablo Canyon with the responsibility for completing the remaining work to restore the Unit 1 low-power license and to obtain the full-power license. In addition, Bechtel completed construction of Unit 2 and provided startup engineering and support services to bring both units into commercial operation. The assignment required the mobilization of over 1,200 Bechtel engineers.

Under Bechtel's project management, an integrated PG&E-Bechtel team was successful in providing the necessary support to respond to the independent design verification program requests, questions, concerns, and findings. The team provided an additional design verification effort to ensure the overall adequacy of the analyses and design of the plant. This was accomplished by organizing and documenting the design records and further developing design data which had not been completely documented over the life of the project. Units 1 and 2 achieved commercial operation in 1985 and 1986, respectively, and have consistently operated at capacity factors well above the industry standard.

Customer Satisfaction:
The completion and licensing of the Comanche Peak plant have been significant challenges. All those involved can take great pride in what has been accomplished. Bechtel made the critical difference at Comanche Peak.

Erle Nye, Chairman
TU Electric, 1993

Comanche Peak Highlights

- Completed a previously listed NRC troubled plant and received the NRC's highest quality rating SALP 1).
- Resolved existing concerns of licensing agencies and the public.
- Built a successful team relationship with the customer and subcontractors from a previously antagonistic environment.
- 20 Bechtel employees managed staff of 10,000 to complete Unit 1.
- Achieved 2.5 million jobhours without a lost-time injury.
- Earned 100% of final incentive award for cost performance.

Diablo Canyon Highlights

- Client trust established through Bechtel's long-term successful performance for PG&E and demonstrated by PG&E naming Bechtel as manager of the combined team.
- Bechtel demonstrated ability to conceptualize management, technical, and regulatory solutions for the plant's complex problems.
- PG&E acknowledged Bechtel's capability to execute real-time, effective transition to full quality work in a highly charged atmosphere.

South Texas Project, Units 1 & 2

PLANT COMPLETION

In late 1981, the owners of the South Texas Project were faced with some very grim statistics and a tough decision. The project was four years behind schedule and project costs had risen considerably from the original $974 million estimate. In addition, an NRC Show Cause order seriously impeded construction. The combined factors of schedule and cost, the regulatory atmosphere so soon after Three Mile Island, and difficulties with design and construction could have led to the complete cancellation of the project, as was the case with other U.S. plants in the same time frame.

The owners faced these problems head on and took the then unprecedented action of relieving the incumbent architect-engineer of design responsibilities and retaining Bechtel as the new architect-engineer.

Bechtel assumed management responsibility for engineering, procurement, and construction management of the South Texas Project in 1981. The transition to Bechtel management was complex, requiring the transfer of over 200,000 documents. In August 1982, less than 1 year after takeover, Bechtel submitted a cost estimate and schedule for completing the project. The previous 8-month schedule delay due to temporary shutdown of construction was recovered, and an additional 11-month saving was achieved. The $5.5 billion budget for total project cost and construction completion dates established was achieved, with Units 1 and 2 going into complete commercial operation in mid-1987 and mid-1989, respectively.

South Texas Project

After the NRC shut down construction because of quality noncompliance by a previous contractor, Bechtel completed the project, meeting all NRC design, construction, safety, and quality licensing requirements and ahead of schedule.

Perry Nuclear Power Plant

PERFORMANCE RECOVERY

Having been placed on the NRC Declining Plants Watch List, the customer requested that Bechtel assist in developing a plan that identified, defined, and clearly presented improvement goals and objectives and methods for measuring progress. The plan also provided budgetary information for project needs and resources. Additionally, Bechtel aided the customer in the proper selection and placement of personnel, improving training, and in the development of an overall plant integrated schedule that included engineering aspects, development of a configuration management program, and development of appropriate budget and cost controls.

In addition to the programmatic and training aspects, Bechtel provided various support services in the form of staff augmentation, mentoring, and out-source design engineering to assist in the Perry recovery program and initial plant operations support. Bechtel's contracting methods were varied as appropriate for each service provided, they consisted of time-and-materials, lump sum, and reward incentive.

The overall recovery program and initial plant operation were highly analyzed by the NRC and INPO. Perry received excellent marks from both organizations, improving from an INPO 3 plant to an INPO rating of 1 within the two years of plant operation following the recovery effort. Perry was one of the fastest and least costly recovery efforts for plants placed on the NRC Watch List.

Perry Nuclear Power Plant

Limerick Generating Station, Unit 2

PLANT COMPLETION

Following the achievement of Unit 1 commercial operation, Unit 2 design and construction was resumed (construction had been previously stopped due to economic issues) based on a PUCmandated cost cap. Bechtel services included overall design responsibility for plant systems and structures, including integration of vendor designs by GE and others. Bechtel was the plant constructor and managed procurement and subcontract activities. Additional scope included implementation of the configuration management program for design and construction, preparation of Preliminary and Final Safety Analysis Reports and environmental reports, and support of Owner in plant licensing activities.

The project was completed 9 months ahead of schedule and at a cost significantly below the mutually agreed upon cost cap budget. The NRC's final Systematic Assessment of License Performance (SALP) for Unit 2 construction and startup activities resulted in highest ratings (Category 1) being assigned for all areas evaluated (construction, engineering/technical support, pre-operational testing, safety assessment/quality verification), a rating never previously achieved by any other nuclear power plant.

Browns Ferry Unit 1

DETAILED SCOPING, ESTIMATING, AND PLANNING STUDY FOR RECOVERY OF UNIT 1

Bechtel provided engineering services to produce a detailed scope, cost estimate, schedules, and planning for the recovery of Browns Ferry Unit 1. Bechtel deliverables included walkdown packages, conceptual designs, development of detailed cost estimates and schedules for Recovery Programs and design change notices, Unit 1 Integration Database task, and risk evaluation.

Bechtel is currently providing plant modification packages and engineering deliverables to conform the plant to current licensing requirements and to prepare the plant for restart. Activities will include scope development of the individual tasks that are performed, engineering design, and management activities necessary to obtain PORC approval of the final modification packages. The Bechtel team is working closely with the TVA design and construction team to develop the necessary modifications so that actual construction activities will be minimized. Work is being performed on a costreimbursable basis with fixed and incentive fees that are performance-based.

Limerick Generating Station Highlights

- Project completed 9 months ahead of schedule.
- Bechtel brought project in at a cost significantly below the mutually agreed upon cost cap budget.
- Highest SALP ratings for all areas evaluated—a rating never previously achieved by any other nuclear power plant.

Browns Ferry Unit 2

UNIT 2 RESTART

Browns Ferry Unit 2

Bechtel provided plant modification packages and engineering deliverables to conform the plant to current licensing requirements and to prepare the plant for restart. Activities included scope development of the individual tasks that were performed, engineering design, and management activities necessary to obtain PORC approval of the final modification packages. The Bechtel team worked closely with the TVA design and construction team to develop the necessary modifications so that actual construction activities were minimized. Work was performed on a cost-reimbursable basis with fixed and incentive fees that were performance-based.

During the initial stages of the Browns Ferry Unit 2 restart effort, work activities were divided between three major contractors. These activities (General Engineering Design, Resolution of 79-14 Issues, and Resolution of Electrical Issues) were three distinct scopes of work that were managed by separate organizations within the TVA management team. Based on the performance of the Bechtel General Engineering Design team and the relationships that were developed with the TVA management organization, the three scopes of work were eventually combined and added to the Bechtel scope of responsibility.

With these changes to the scope of work, Bechtel became the major engineering contractor of all Browns Ferry Unit 2 restart activities. Bechtel was able to develop processes that allowed us to complete designs and obtain PORC approvals in a timely manner, thus adding value related to the restart of the unit.

Browns Ferry Unit 3

UNIT 3 RESTART

Browns Ferry Unit 3

Bechtel's scope included project management, engineering, and procurement. Project management included planning, scheduling, and cost engineering. Engineering efforts included: design basis reconstitution work, design change package engineering work, licensing support, modification implementation support, programmatic evaluations, Generic Issues review and closeout, Employee Concerns evaluation and closeout, coordination with Unit 2 Operations and System Engineering, field support, and design change closure support. Procurement efforts included purchasing of materials and equipment associated with Unit 3 restart and also included the procurement engineering function. Work was performed on a cost plus incentive fee basis with performance evaluated quarterly based on a list of predetermined criteria (for example, schedule performance, cost performance) and the fee received based on the outcome of the performance evaluation.

D. C. Cook

UNITS 1 AND 2 RESTART

Bechtel scope included planning and implementation of 200+ major plant modifications in support of the recovery and restart program. Key categories of modifications included large bore piping and supports, HVAC, civil/structural, and electrical distribution. The work was performed under a unit price contract with a portion of our revenue at risk. An assessmentof performance was conducted quarterly.

Bechtel's performance was severely impacted by the recovery architect-engineer not being located on site and their not participating in system and work walk downs. In some cases we had design change packages with over 100 field change requests to designs that were physically impossible to build or implement.

Work was conducted in a very fast-paced environment and required a significant degree of coordination and communication. Strong, effective interface with all site organizations was required. Material availability was just in time, thus requiring a substantial effort to manage labor resources. Work was of high quality and managed and reported in an effective manner.